



Value Management

BTeV Document # 3578

November 7, 2004

Assembled by T. Lackowski



VALUE MANAGEMENT

TABLE OF CONTENTS

Project Description and Background	3
BTeV VM Program Summary	5
Proposals	
WBS 1.0 BTeV Detector	7
1.2 Pixel Detector	
Pixel vs. strip as basic vertex detector concept	
Deep submicron vs. military process for readout chips	
P-spray vs. p-stop isolation on the sensors	
Fuzzy carbon vs. Thermal Pyrolytic Graphite substrate support	
LN2 cooling vs. water/glycol or any active coolant	
Piezo electric actuators vs. pneumatic or hydraulic driven ones	
Titanium sublimation pumps vs. liquid helium cryo pumps in vacuum system	
1.3 RICH	
Change in baseline photon detector for gas rich	
1.4 EMCAL	
Light pulser for calibration	
1.8 Trigger 1.9 Data Acquisition	
Pixel and non-Pixel Data Combiner designs were merged.	
Use of commodity computers and networking equipment	
Implemented a disk-based data staging system data storage4	
Rely on open source software	
Moved to a staged schedule with potential to reduce the size of the second stage equipment order based on adjustments to the bandwidth requirements.	
WBS 2.0 BTeV Interaction Region.....	13
C0 IR Lattice	
Use existing HTS leads in the C0 IR	
WBS 3.0 C0 Outfitting.....	17
Use of Pond for rejecting heat vs. Air Chiller	
Eliminate the Electronics Bridge and Replace with Bay at Stair #3	

VALUE MANAGEMENT

PROJECT DESCRIPTION AND BACKGROUND

The BTeV Project

The purpose of the BTeV Project is to design, construct, and install the BTeV detector, interaction region, and supporting experimental facilities needed to achieve the physics goals set out in the BTeV Proposal Update of April 2002. Beginning in CY 1998, an effort has been underway to carry out conceptual design activities and R&D to be able to construct this detector. This has resulted in a detailed technical design, described in the BTeV Detector Technical Design Report. Parallel efforts to design and specify the components of the Interaction Region, usually referred to as the “IR”, and develop a conceptual design began in 2000. At the same time a project was initiated to design and specify the changes that need to be made in and around the C0 interaction region of the collider to support the BTeV experiment. This activity is referred to as the “C0 Outfitting” (sub)project. The implementation of all three of these components, BTeV detector, C0 Interaction Region and C0 Outfitting is referred to as the “BTeV Project” and is the subject of this Value Management report.

The principal elements of the BTeV Detector sub-project are:

- 1.1 Modification and installation of an existing analysis magnet, construction of two toroids (using existing steel), and construction of beam pipes that provide the physical infrastructure of BTeV experiment;
- 1.2 Construction of a silicon pixel vertex detector to reconstruct primary interaction vertices and secondary decay vertices and which can be used in the lowest level trigger of the experiment;
- 1.3 Construction of a Ring Imaging Cherenkov counter (RICH) to provide charged hadron identification;
- 1.4 Construction of a high resolution, highly segmented electromagnetic calorimeter to reconstruct photons and π^0 's;
- 1.5 Construction of a muon detector that can also be used in a stand-alone lowest level trigger;
- 1.6 Building of a forward tracker based on straw detector technology that covers large angles with respect to the beam and provides tracking in the downstream part of the detector and improves the momentum measurement obtained from the pixel detector alone;
- 1.7 Building of a forward tracker based on silicon microstrip technology that covers small angles with respect to the beam to provide tracking in the downstream part of the detector;
- 1.8 Construction of a three level trigger system, including all hardware and software, which is highly efficient for a large variety of bottom and charm decays and achieves excellent rejection of light-quark events;
- 1.9 Building of a data acquisition system and all necessary interfacing electronics and software to record all events containing a wide variety of bottom and charm decays; and
- 1.10 Installation in the C0 collision hall, alignment, integration, debugging, and technical commissioning (described below) for all components.

The principal elements of the C0 Interaction Region subproject are:

- 2.0 Construction of a straight section for parasitic testing of BTeV detector components as they are completed, and installation of the C0 Interaction region to produce high luminosity, 1 to $2 \times 10^{32}/\text{cm}^2\text{-s}$, which will enable BTeV to achieve its design sensitivity. This requires the design of a low-beta insertion to have collisions at high luminosity in the C0 Interaction Region, to construct the components to implement the design, and to install and commission the components.

The principal elements of the C0 Outfitting subproject are:

- 3.0 Construction of the architectural finishes, mezzanine structures, heating, ventilation, air conditioning (HVAC), process piping systems, and power to support the BTeV detector and upgrade of the C0 Service Building, including architectural modification, HVAC and power to support the Interaction Region at C0.

VALUE MANAGEMENT

BTeV VM PROGRAM SUMMARY

Value Management (VM) utilizes the total resources available to the BTeV organization to achieve broad, top management objectives. VM is an integral part of the overall project delivery process and is not a separate entity. VM is a systematic and creative approach for increasing the “return on investment” in components, systems, facilities, and other products required for BTeV. Increased return on investment for BTeV and DOE results with the lower cost for the acquisition of systems, equipment, facilities, services, and supplies, while maintaining the required level of performance. Value Management has been accomplished in many of the BTeV Detector, C0 Interaction Region and C-0 Occupancy sub-projects. The function of this document is to collect and record the various Value Management efforts to date. This document will be updated to incorporate additional Value Management proposals as they are developed.

The Level two and Level three managers are responsible for promoting and performing Value Management at all stages of the design. Task groups or internal design review provide the stage for the Value Management process. Collaboration meetings and Tech board meetings are the setting for analysis of VM proposals. The set points that determine the required level of approval is that which is described in the Project Management Plan (PMP) for change control. All change control provisions are to be strictly adhered to prior to implementing a VE proposal starting with project baseline approval. The sub-projects studies use the Corps of Engineers standard Value Management methodology, consisting of five phases:

Information Phase: Sub-project teams study criteria, drawings, figures, descriptions of project work, schedules and cost estimates to fully understand the work to be performed and the functions to be achieved. Cost Estimates are compared to determine areas of relative high cost to ensure that focus is on those parts of the project that offer the most potential for cost savings.

Speculation Phase: The Sub-project team speculated by conducting brainstorming sessions to generate ideas for alternative designs. All team members contributed ideas and critical analysis of the ideas is discouraged.

Analysis Phase: Evaluation, testing and critical analysis of all ideas generated during speculation are performed to determine potential for savings and possibilities for risk. Initial costs as well as life cycle costs are considered. Ideas are ranked by priority for development. Ideas which do not survive critical analysis are deleted.

Value Management Proposal: Ideas are developed into written proposals by Level 2 or Level 3 managers. Proposal descriptions, along with sketches, technical support documentation, and cost estimates are prepared to support implementation of ideas.

Value Management Presentation: Proposals are presented to the sub-project team and incorporated into the work if minor in nature and the effects are self-contained within the sub-project. Proposals that affect the baseline or multiple sub-projects are presented to the Tech Board, the BTeV Collaboration or both. Change control is enacted whenever required.

BTeV Project Organization, Methods of Value Management

The BTeV project and collaboration has, from its inception, followed best management practices. Striving to achieve the core objectives of Value Management has always been a consistent goal of project and subproject management. The projects process that was used to develop the various detectors and subprojects mimics the Value Management process. The proposal description for the Pixel detector, WBS 1.2, demonstrates how the process has been followed for that sub-project. Particulars of the Value Management process used in the various sub-projects differ slightly but follows the overall process described.

Training

Training Level 2 and / or Level 3 sub-project managers in the Value Management process and methodologies has been accomplished by the distribution and discussion of the U.S. Department of Energy, Office of Management, Budget and Evaluation, Value Management, Rev. E, dated June 2003. Additional training has occurred at collaboration and Tech. Board meetings.

VALUE ENGINEERING PROPOSALS

PROPOSAL BTeV Pixel Detector Sub-Project
LEVEL 2 MANAGER: Simon Kwan

WBS: 1.2

DESCRIPTION: Introduction and History

Value engineering has been the normal practice in developing the pixel detector for BTeV. Examples of value engineering decisions which have been made for the pixel detector include

1. Pixel vs. strip as basic vertex detector concept
2. Deep submicron vs. military process for readout chips
3. P-spray vs. p-stop isolation on the sensors
4. Fuzzy carbon vs. Thermal Pyrolytic Graphite substrate support
5. LN2 cooling vs. water/glycol or any active coolant
6. Piezo electric actuators vs. pneumatic or hydraulic driven ones
7. Titanium sublimation pumps vs. liquid helium cryo pumps in vacuum system

The methodology used for these decisions passes through the following phases (taken from guidance on Value Management from the Corps of Engineers):

1. Information Phase

This phase was dominated by the development of the specifications for the pixel detector. These specifications were developed by the subproject team, using simulation studies to determine the impact on the physics reach and goals of the experiment.

The performance specifications can be found in the BTeV Document Database.

2. Speculation Phase

A first pixel system design was developed and reported upon in presentations to the full BTeV collaboration and to the wider community of detector builders and physicists at conferences and publications. A list of these publications is available on the web at

http://www-btev.fnal.gov/public/hep/detector/pixel/status/pixel_papers.shtml

3. Analysis Phase

Value engineering was performed by comparing engineering solutions to the initial design, including considerations of cost, buildability, reliability, and effect on the physics goals of the experiment.

Those parts of the project with the longest lead times and greatest risk received earliest attention. These included the development of sensors and readout chips. Later, attention was focused on the support structure, cooling, and vacuum systems for the pixel detector.

4. Value Management Proposal

Significant changes to the initial system design were incorporated only after extensive discussions in the regular Pixel Group meetings (by-weekly) and Pixel Mechanical Group meetings (alternate weeks).

5. Value Management Presentation

Tests of components to see that they met (or where they failed to meet) specified performance included bench tests of prototypes, irradiation tests, and beam tests.

Presentations of the results of these tests were presented at the same meetings discussed above and reported to the collaboration and in conferences and publications. The presentations are available in the BTeV Document Database and among the listed publications at the web site above.

Final acceptance of significant changes from the baseline detector system (defined by the Preliminary Technical Design Report – BTeV Document BTeV-doc-32-v2, Preliminary TDR, 26 Mar 2003) are made only after presentation to and approval by the BTeV Technical Board.

This process has been followed for the change to the substrate design and the cooling system.

Continuing Value Engineering Management

The first five issues above have been resolved and taken through the above value engineering management, and are now part of the pixel detector system for BTeV, ready for base lining by the Department of Energy.

As examples, here are representative samples of documentation of the value engineering process for two of the above engineering issues:

1. Fuzzy carbon vs. TPG

DESCRIPTION: Pixel station substrate design, material choice and cooling design.

ORIGINAL DESIGN: Fuzzy carbon with embedded glassy carbon cooling tubes.

PROPOSED DESIGN: TPG substrates using conductive cooling path to LN2 cold blocks.

ADVANTAGES: Simplified mechanical and cooling design. Integration of cooling system with cryogenic vacuum system. Utilization of materials known to be able to be manufactured in the required quantities (reduced technical, cost and schedule risk).

DISADVANTAGES: Major redesign of the pixel mechanical and cooling systems, materials testing and certification and systems testing are required. Much of this work remained to be done for the original design so it is not a large incremental effort. The pixel power (~3kW) is removed at 77K rather than ~250K reducing the efficiency of the cooling system. This has limited impact on the total cost for deployment plus operational costs over the life of the experiment.

JUSTIFICATION: The original design featured a large number for cooling channels containing water-based fluids inside the vacuum of the TeVatron. These glassy carbon tubes were felt to have an unacceptable probability of failure that could lead to a water to vacuum leak. In addition it was not clear that the (only) vendor could deliver the substrates within a reasonable cost and schedule. The new design uses materials that have been mass-produced for other detector systems, notably ATLAS, and contains no liquid to vacuum joints. It also takes advantage of existing infrastructure within the pixel tank, required for the vacuum system, as a sink to cool the pixels, completely eliminating the independent cooling system required in the original design.

List of documents:

- Substrate RD after Temple (doc-1356)
- Advancing the discussion of support/cooling approaches (doc 1368)
- Pixel detector support and cooling options worksheet (doc 1381)
- A development plan for a TPG/Cold-finger Pixel Substrate (doc 1367)
- Update on Pixel TPG substrate development (doc 1415)
- Change to TPG substrate (doc 1708 - Presentation to Technical Board, April 2003)

Cost Estimate:

- Fuzzy carbon about \$500K
- TPG substrate and post-delivery machining: \$300K

Status: Presented to PAC, Spring 2003 and approved by Technical Board April 2003

2. Cooling

Substrate Cooling using controlled flow of LN2 (doc 1359)

LN2 as a substrate coolant: Advantage and Disadvantage (doc 1370)

Comments on water to vacuum joints in Pixel Detector (doc 1366)

ESLI Ovalized dogleg tube panel (doc 1163)

Status: approved at the same time as TPG

The Pixel Group is committed to value engineering of their detector and will continue to use the value engineering procedures above to resolve the remaining issues as the final detector design is developed and implemented.

VALUE ENGINEERING PROPOSAL

PROPOSAL

WBS: 1.3

DATE: February 2004

LEVEL 2 MANAGERS: M. Artuso, T. Skwarnicki

DESCRIPTION: Change in baseline photon detector for gas rich

ORIGINAL DESIGN: 944 HPDs

PROPOSED DESIGN: 9016 MaPMTs

ADVANTAGES : Lower cost of MaPMT system due to very unfavorable exchange rate between EU and USD. In addition this system uses conventional High Voltage system [0.6-1 KV] rather than 20KV. The higher gain makes the noise requirements in the front-end electronics easier to meet. The geometry allows the use of conventional PCBs to host the front-end hybrids.

DISADVANTAGES: The higher current draw in the MaPMT bases requires cooling.

JUSTIFICATION: The advantages summarized before lead us to the implementation of a cheaper system, that reduces the hazards involved in the design and make the requirements on the front-end electronics more manageable.

COST ESTIMATING WORKSHEET

ORIGINAL DESIGN

ITEM	UNIT	QTY	UNIT COST (\$)	TOTAL (\$)
DELETE	HPD	944	6629	6,257,776
SUBTOTAL				

PROPOSED CHANGE

ITEM	UNIT	QTY	UNIT COST (\$)	TOTAL (\$)
ADD	MaPMT	9016	534	4,814,544
SUBTOTAL				
Net savings				
SAVINGS				1,443,232

PROPOSAL STATUS:

___ Pending Review X Approved Via Tech Board
X Approved Via Collaboration ___ Approved Via Change Control Board
___ Approved Via L2 Manager ___ Rejected

VALUE ENGINEERING PROPOSAL

PROPOSAL
LEVEL 2 MANAGER:

WBS: 1.4
Yuichi Kubota

DATE: 11/02/04

DESCRIPTION: light pulser for calibration

ORIGINAL DESIGN: uses laser

PROPOSED DESIGN: uses LED's

ADVANTAGES: cheaper, more stable, not coherent (coherent light in this application causes problem because it is very sensitive to interference and lead to unstable light intensity at crystals)

DISADVANTAGES: intensity tends to be lower than laser, but recent development of high-intensity LED's, particularly in the blue region, is sufficient to use them in our application.

JUSTIFICATION:

Disadvantage has been overcome by recent technological advancements in the LED technology. So there are valid reasons to use LED's.

COST ESTIMATING WORKSHEET ORIGINAL DESIGN

ITEM	UNIT	QTY	UNIT COST (\$)	TOTAL (\$)
CMS budgeted light pulser was	1	1	80k	80k
CMS needed light switch	1	1	100k	100k
SUBTOTAL				180k

PROPOSED CHANGE

ITEM	UNIT	QTY	UNIT COST (\$)	TOTAL (\$)
LED based light pulsers	4	4	5k	20k
SUBTOTAL				20k
Net savings				160k
Indirect and Contingency				64k
TOTAL SAVINGS				224k

PROPOSAL STATUS:

<p><input type="checkbox"/> Pending Review</p> <p><input checked="" type="checkbox"/> Approved Via Collaboration</p> <p><input checked="" type="checkbox"/> Approved Via L2 Manager</p>	<p><input type="checkbox"/> Approved Via Tech Board</p> <p><input type="checkbox"/> Approved Via Change Control Board</p> <p><input type="checkbox"/> Rejected</p>
---	--

VALUE ENGINEERING PROPOSAL

PROPOSAL
LEVEL 2 MANAGERS:

WBS: 1.8 & 1.9
Gottschalk / Votava

DESCRIPTION: In WBS 1.9 (Readout and Controls), the cost savings all fall under the category of "cost avoidance". The following design decisions were made at various stages of the development with the goal of reducing costs. Overall savings are estimated at \$1-2M.

- 1 The Pixel and non-Pixel Data Combiner designs were merged, resulting in a reduction in design labor costs. The pre-pilot Level 1 Buffer and Timing systems are now based on work done for the TeVatron IPM and BPM projects, respectively. This reduces the number of design cycles from three to two for these subprojects. Changes in packaging and implementation have reduced costs by 30% for the Level 1 Buffers, in comparison to the original design.
- 2 Use of commodity computers and networking equipment, and have delayed purchases of commodity items to maximize cost/performance. This is in place of the traditional industrial style equipment, which is 4-5 times the cost. For non-commercial items, we plan extensive use of built-in test methodologies to reduce the number of dedicated test stands and test labor.
- 3 Implemented a disk-based data staging system data storage that will allow reuse of the Level 2/3 processors during off-peak operation. The cross-over point in the cost of optical storage vs. magnetic tape is occurring now, so we will base the choice of permanent storage technology on the results of this transition.
- 4 We will also rely on open source software (operating systems and databases) whenever possible. For each software subproject, we review existing implementations for reuse.
- 5 The move to a staged schedule has a potential cost advantage of allowing us to reduce the size of the second stage equipment order based on adjustments to the bandwidth requirements. This will be determined by results of the first stage operation. The change to a "highway" architecture provides a similar potential savings.

VALUE ENGINEERING PROPOSAL

PROPOSAL C0 IR Lattice **WBS:** 2.0 **DATE:** 7/27/04
LEVEL 2 MANAGER: Mike Church

DESCRIPTION: Proposal to modify the C0 IR lattice insertion. Full documentation is in btev-doc-3230.

ORIGINAL DESIGN: Original design produced a first parasitic beam-beam crossing separation of 3.5 beam ?'s. It utilized 2 types of X2 spools (right and left).

PROPOSED DESIGN: The proposed design produces a first parasitic beam-beam crossing separation of 6.5 beam ?'s. It utilizes 1 type of X2 spool. Magnetic elements are rearranged slightly.

ADVANTAGES : 1) Larger beam-beam separation produces a more dynamically stable lattice. 2) Reduced number of spool types reduces the number of required spare spools by 1. 3) Rearrangement of magnetic devices reduces the total cost of non-magnetic cryogenic devices.

DISADVANTAGES: None

JUSTIFICATION: The more dynamically stable lattice will yield improved luminosity lifetimes in the Tevatron, increasing BTeV integrated luminosity. The overall project cost is reduced.

COST ESTIMATING WORKSHEET (includes Project and Spares costs; includes M&S and Labor; includes G&A)

ORIGINAL DESIGN

ITEM	UNIT	QTY	UNIT COST (K\$)	TOTAL (K\$)
HTS leads	pair	14	150	2100
corrector packages	each	20	75	1500
spool assemblies	each	15	359	5385
nonmagnetic cryogenic elements	each	9	variable	1267
SUBTOTAL				10252

PROPOSED CHANGE

ITEM	UNIT	QTY	UNIT COST (K\$)	TOTAL (K\$)
HTS leads	pair	13	150	1950
corrector packages	each	18	75	1350
spool assemblies	each	14	359	5026
nonmagnetic cryogenic elements	each	7	variable	1196
SUBTOTAL				9522
Net savings				730
Indirect and Contingency				38%
TOTAL SAVINGS				1007

PROPOSAL STATUS: The proposal is fully documented in btev-doc-3276 and btev-doc-3230. It has been reviewed and approved up to and including the FNAL Directorate in accordance with the BTeV Project Change Control procedures outlined in the BTeV PMP. Cost and schedule details have been fully incorporated into the C0 IR WBS. Technical details have been fully incorporated into the C0 IR TDR.

<input type="checkbox"/>	Pending Review	<input checked="" type="checkbox"/>	Approved Via Tech Board
<input type="checkbox"/>	Approved Via Collaboration	<input type="checkbox"/>	Approved Via Change Control Board
<input checked="" type="checkbox"/>	Approved Via L2 Manager	<input type="checkbox"/>	Rejected

VALUE ENGINEERING PROPOSAL

PROPOSAL Use existing HTS leads in the C0 IR **WBS:** 2.0
LEVEL 2 MANAGER: Mike Church

DATE: 8/21/04

DESCRIPTION: There are 7 HTS lead pairs in the FNAL/TD Special Process Spares pool. These were previously tested at 6 kA. We have recently successfully tested one of these pairs at 10 kA, therefore we deem them suitable for use in the C0 IR.

ORIGINAL DESIGN: 13 new 10 kA HTS lead pairs would be purchased from a vendor.

PROPOSED DESIGN: 6 new 10 kA HTS lead pairs will be purchased from a vendor. 7 existing lead pairs will be purchased from the FNAL/TD Special Process Spares pool at a reduced price and operated at 10 kA.

ADVANTAGES : Reduced cost. Additional float in the schedule

DISADVANTAGES: None

JUSTIFICATION: An existing 6 kA lead pair was successfully tested at 10 kA under controlled conditions equivalent to Tevatron operating conditions. Also a 6 kA lead pair previously installed in an H-spool underwent limited tests at 9.6 kA successfully. On the basis of these tests we are confident that the lead pairs previously tested at 6 kA can be operated successfully at 10 kA. This will reduce overall project cost and increase the schedule float for this item.

COST ESTIMATING WORKSHEET (includes Project and Spares costs; includes M&S and Labor; includes G&A)

ORIGINAL DESIGN

ITEM	UNIT	QTY	UNIT COST (K\$)	TOTAL (K\$)
new HTS leads	pair	13	150	1950
SUBTOTAL				1950

PROPOSED CHANGE

ITEM	UNIT	QTY	UNIT COST (K\$)	TOTAL (K\$)
new HTS leads	pair	6	150	900
existing HTS leads	pair	7	104	728
SUBTOTAL				1628
Net savings				322
Indirect and Contingency				40%

TOTAL SAVINGS				451
---------------	--	--	--	-----

PROPOSAL STATUS: Tests of existing HTS leads has been documented in an internal TD note. The new cost and schedule details have been fully incorporated into the C0 IR WBS. The review process is complete at the L2 Manager level.

<input type="checkbox"/>	Pending Review	<input type="checkbox"/>	Approved Via Tech Board
<input type="checkbox"/>	Approved Via Collaboration	<input type="checkbox"/>	Approved Via Change Control Board
<input checked="" type="checkbox"/>	Approved Via L2 Manager	<input type="checkbox"/>	Rejected

VALUE ENGINEERING PROPOSAL

PROPOSAL

WBS: 3.0

DATE: Oct 8 to 10 2003 (See Note 1)

LEVEL 2 MANAGER: T.Lackowski

DESCRIPTION: Use of Pond for rejecting heat vs. Air Chiller

ORIGINAL DESIGN: Air-cooled Chiller

PROPOSED DESIGN: Use Pond Water/ICW

ADVANTAGES : Lab Use in other areas / Typically good life cycle cost based on past project but typically high first cost. (note 3)

DISADVANTAGES: Will require additional space for strainers, heat exchangers and pumps, and high first cost

JUSTIFICATION: N/A: Note 1 (Initial cost during Oct 10 2003 included items that were eventually deleted or removed from WBS scope, such as LCW, ECW and various back up equipment)

COST ESTIMATING WORKSHEET

ORIGINAL DESIGN

ITEM	UNIT	QTY	UNIT COST (\$)	TOTAL (\$)
Convert Air system rejection to water cooled	1	LOT	\$702,062	
SUBTOTAL			\$702,062	

PROPOSED CHANGE

ITEM	UNIT	QTY	UNIT COST (\$)	TOTAL (\$)
ADD ICW system for chiller & Free Cooling	1	LOT	\$870,306	
& convert heat rejection to water cooled				
SUBTOTAL			\$870,306	
Net savings			\$(168,244)	
TOTAL SAVINGS (1 st cost only –see note 3)			\$(168,244)	

Note 3 (During the development of this ICW option, it became apparent that the space will be a major issue for the pond/ICW option. Because of this, we did not continue pursuing the life cycle cost, or any other related item, beyond the cost estimate)

PROPOSAL STATUS:

—	Pending Review	—	Approved Via Tech Board
—	Approved Via Collaboration	—	Approved Via Change Control Board
—	Approved Via L2 Manager	<u>X</u>	Rejected

VALUE ENGINEERING PROPOSAL

PROPOSAL

WBS: 3.0

LEVEL 2 MANAGER: Lackowski

DESCRIPTION: Eliminate the Electronics Bridge and Replace with Bay at Stair #3

ORIGINAL DESIGN: The original design erected a two-story space spanning across the high bay directly over the rolling door leading to the Collision Hall. The space was a long inflexible space. The Electronics Bridge restrained the crane travel.

PROPOSED DESIGN: The proposed design takes advantage of the footings installed in the original construction and constructs a 25' x 25' bay off the northeast corner of the building. One story, and three story bays were examined (425 net sf per floor additional space)

ADVANTAGES : The construction of the Electronics Bridge required difficult and specialized construction. By adding the space in a standard 25' x 25' bay allows for flexibility for rack and tech space layout. The three-story space allows for expansion of the number of racks without exceeding 8kw per rack and thus not requiring specialized cooling. The proposed required stair and the existing foundations provide economies of design. Cable lengths have been studied with a very slight increase in total length of cable.

DISADVANTAGES: A three-story bay provides a minor amount of space that is at this time not programmed. The cost for the three-story bay is slightly above the original base cost but is extremely cost effective and provides a modest amount of space for expansion. A one or two story bay would be extremely difficult to expand at a later date, thus pushing towards a three-story solution.

JUSTIFICATION: The proposed space is flexible, of standard construction providing value to the government.

COST ESTIMATING WORKSHEET

ORIGINAL DESIGN

ITEM	UNIT	QTY	UNIT COST (\$)	TOTAL (\$)
DELETE				
Electronic bridge	Lot	1	\$110,234	\$110,234
SUBTOTAL				

PROPOSED CHANGE

ITEM	UNIT	QTY	UNIT COST (\$)	TOTAL (\$)
ADD				
Three Story Proposal	1	Lot	\$135,074	\$135,074
SUBTOTAL				
Net savings				
TOTAL SAVINGS				(\$24,840)

PROPOSAL STATUS:

<u> </u>	Pending Review	<u> X </u>	Approved Via Tech Board
<u> </u>	Approved Via Collaboration	<u> </u>	Approved Via Change Control Board
<u> X </u>	Approved Via L2 Manager	<u> </u>	Rejected

FERMILAB: FESS COST ESTIMATE

Project Title: Electronic Bridge Value Engineering Study				Project No: 6-8-3	Status: CDR	Date: 9/15/04	Revision Date:
ITEM NO.	DESCRIPTION OF WORK:			QUANTITY	UNITS	UNIT COST	AMOUNT
	Electronic Bridge Base						\$110,234
05	METAL						
	Electronics' Bridge		\$48,250				
	Floor and wall Struct 7' x 33' x 2			450	SF	\$50	\$22,500
	Roof			225	SF	\$10	\$2,250
	Computer Floor			450	SF	\$30	\$13,500
	M/E			1	Lot	\$10,000	\$10,000
200	Stair Enclosure and Misc. Steel		\$23,936				
	Stair enclosure columns W8 x 31 x 29'-6" x 4			1.9	tons	\$2,600	\$4,940
	Wall purlins C 8 x 11.5 x 32' x 4			0.8	tons	\$2,800	\$2,240
	Stair Enclosure Roof Beam W8 x 21 x 48'			0.6	tons	\$2,500	\$1,500
	Roof Floor Angles L5x3 @t# x 32" x 2			0.3	tons	\$3,000	\$900
	Stair enclosure Roof Deck 8' x 16'			128	SF	\$2	\$256
	New Side Stair			34	Risers	\$150	\$5,100
	Landings 4'x 7'-6" x4			120	SF	\$75	\$9,000
07	Moisture - Thermo Control		\$38,048				
	Preformed Roofing & Siding		\$33,950				
	Metal Siding 2-Pcs W /insul						
	Siding for Stairway 32' x 36'			1150	SF	\$29	\$33,350
	Flashing and trim			60	LF	\$10	\$600
	Membrane Roofing		\$4,098				
	Roofing 4-Ply						
	3" Insul Board and roofing @ stair 9' x 16'			144	SF	\$5	\$648
	Blocking and Flashing			130	LF	\$15	\$1,950
	Rework Existing Roof			1	Lot	\$1,500	\$1,500

Project Title:		Project No.	Status:	Date:	Revision Date:
Electronic Bridge Value Engineering Study		6-8-3	CDR	9/15/04	
ITEM NO.	DESCRIPTION OF WORK:	QUANTITY	UNITS	UNIT COST	AMOUNT
Three Story Addition Proposal					\$135,074
03	CONCRETE				
	Floor Deck El: 755-4				
	8" PT Concrete Slab	10.50	CY	\$800	\$8,400
	Edge angles	50	LF	\$2	\$100
	Floor Deck El: 766-0				
	8" PT Concrete Slab	10.5	Cy	\$800	\$8,400
	Edge angles	50	LF	\$2	\$100
04	MASONRY				
	8" Concrete Block	500	SF	\$9	\$4,300
	Remove/Dispose Temp Partitions	1	Lot	\$1,000	\$1,000
05	METAL				
	100 Mezz Structural Steel				
	Stl. Columns W12x58 x 14 x 2	0.8	tons	\$2,600	\$2,080
	Girders W12 x 31 x 25' x 2	1.55	tons	\$2,000	\$3,100
	Beams W16 x 26 x 25' x 6	1.95	tons	\$2,000	\$3,900
	Beam Clips 21 X 4	16	Ea	\$20	\$320
	Misc. Steel	1	lot	\$2,000	\$2,000
	Floor Beams	1.3	tons	\$2,000	\$2,600
	200 Stair Enclosure and Misc. Steel				
	Stair enclosure columns W8 x 31 x 29'-6" x 4	1.9	tons	\$2,600	\$4,940
	Wall purlins C 8 x 11.5 x 32' x 4	0.8	tons	\$2,800	\$2,240
	Stair Enclosure Roof Beam W8 x 21 x 48'	0.6	tons	\$2,500	\$1,500
	Roof Floor Angles L5x3 @t# x 32" x 2	0.3	tons	\$3,000	\$900
	Stair enclosure Roof Deck 8' x 16'	128	SF	\$2	\$256
	New Side Stair	34	Risers	\$150	\$5,100
	Landings 4'x 7'-6" x 4	120	SF	\$75	\$9,000
07	Moisture - Thermo Control				
	Preformed Roofing & Siding				
	Metal Siding 2-Pcs W /insul				
	Siding for Stairway	2000	SF	\$29	\$58,000
	Flashing and trim	120	LF	\$10	\$1,200
	Membrane Roofing				
	Roofing 4-Ply				
	3" Insul Board and roofing @ 25 x 25	625	SF	\$5	\$2,813
	Blocking and Flashing	75	LF	\$15	\$1,125
	Rework Existing Roof	1	Lot	\$1,500	\$1,500
10					
	Additional Fire Protection				
	El 746 Sprinkler	425	SF	\$8	\$3,400
	El 755 Sprinkler	425	SF	\$8	\$3,400
	El 766 Sprinklers	425	SF	\$8	\$3,400

Project Title:		Project No.	Status:	Date:	Revision Date:
Electronic Bridge Value Engineering Study		6-8-3	CDR	9/15/04	
ITEM NO.	DESCRIPTION OF WORK:	QUANTITY	UNITS	UNIT COST	AMOUNT
One Story Addition Proposal					\$110,803
03	CONCRETE				
	Floor Deck EI: 755-4				
	8" PT Concrete Slab	10.50	CY	\$800	\$8,400
	Edge angles	50	LF	\$2	\$100
04	MASONRY				
	8" Concrete Block	500	SF	\$9	\$4,300
	Remove/Dispose stair siding	1	Lot	\$1,000	\$1,000
05	METAL				
100	Mezz Structural Steel				
	Stl. Columns W12x58 x 14 x 2	0.8	tons	\$2,600	\$2,080
	Girders W12 x 31 x 25' x 2	10.2	tons	\$2,000	\$20,400
	Beams W16 x 26 x 25' x 6	1.95	tons	\$2,000	\$3,900
	Beam Clips 21 X 4	16	Ea	\$20	\$320
	Misc. Steel	1	lot	\$2,000	\$2,000
200	Stair Enclosure and Misc. Steel				
	Stair enclosure columns W8 x 31 x 29'-6" x 4	1.9	tons	\$2,600	\$4,940
	Wall purlins C 8 x 11.5 x 32' x 4	0.8	tons	\$2,800	\$2,240
	Stair Enclosure Roof Beam W8 x 21 x 48'	0.6	tons	\$2,500	\$1,500
	Roof Floor Angles L5x3 @t# x 32" x 2	0.3	tons	\$3,000	\$900
	Stair enclosure Roof Deck 8' x 16'	128	SF	\$2	\$256
	New Side Stair	34	Risers	\$150	\$5,100
	Landings 4'x 7'-6" x 4	120	SF	\$75	\$9,000
07	Moisture - Thermo Control				
	Preformed Roofing & Siding				
	Metal Siding 2-Pcs W /insul				
	Siding for Stairway 16' x 36'	576	SF	\$29	\$16,704
	Siding for building	600	SF	\$29	\$17,400
	Flashing and trim	60	LF	\$10	\$600
	Membrane Roofing				
	Roofing 4-Ply				
	3" Insul Board and roofing @ stair 25' x 25'	625	SF	\$5	\$2,813
	Blocking and Flashing	130	LF	\$15	\$1,950
	Rework Existing Roof	1	Lot	\$1,500	\$1,500
10	Fire Protection				
	EI 746 Sprinkler				
		425	SF	\$8	\$3,400

VALUE ENGINEERING PROPOSAL

**PROPOSAL
LEVEL 2 MANAGER:**

WBS:

DATE:

DESCRIPTION:

ORIGINAL DESIGN:

PROPOSED DESIGN:

ADVANTAGES :

DISADVANTAGES:

JUSTIFICATION:

COST ESTIMATING WORKSHEET ORIGINAL DESIGN

ITEM	UNIT	QTY	UNIT COST (\$)	TOTAL (\$)
DELETE				
SUBTOTAL				

PROPOSED CHANGE

ITEM	UNIT	QTY	UNIT COST (\$)	TOTAL (\$)
ADD				
SUBTOTAL				
Net savings				
Indirect and Contingency				
TOTAL SAVINGS				

PROPOSAL STATUS:

___ Pending Review

___ Approved Via Tech Board

___ Approved Via Collaboration

___ Approved Via Change Control Board

___ Approved Via L2 Manager ___ Rejected